



Patent Application of Franklin Zhigang Zhang
for

**TITLE: Computer Board with Dual Shield Housing And Heat Sink
Expansion Zone Apparatuses**

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of the Provisional Patent Application Ser.No.
60/256,414 filed 12/18/2000.

BACKGROUND – FIELD OF INVENTION

This invention is concerned with a computer system board, specifically a computer system board with [[dual shield housing solutions]] dual complete EMI shield and heat conduction housing solutions for critical environment applications.

BACKGROUND – DESCRIPTION OF PRIOR ART

It is known in the art of the regular Personal Computer (PC) and industrial PC system board design, expansion slots are one of the key mechanisms on the board. They provide the hardware expandability of the system board. On a regular PC system board, ISA, PCI or PCMCIA slot can always be found. PC-104's interfaces were introduced to be the main expansion standard for stackable industrial PC. [[To expand hardware applications, you can simply insert the compatible add-on cards into the slots on the system board.]] Add-on expansion daughter cards are mounted in to the expansion connectors/slots on the computer main system board/mother board for expanding the system functions. There is no strict requirement on the size of a regular PC system board. [[Electronic components always generate heat and EMI.]] In the [[prior art of the PC]] art of computer system design, in order to eliminate the interference and ~~get better~~ having sufficient heat dissipation, [[certain spacing and size is required.]] the computer systems are designed with certain spacing and size to meet the requirements. To ~~avoid EMI or solve EMI~~ and/or heat issues, the system board is usually designed ~~in bigger size~~ in big size with sufficient spacing for the add-on expansion daughter cards. [[But when the size of equipment is limited, the size of system board is therefore limited.]] However, in the application cases where the hardware system sizes are limited, and the installation environment is critical such as outdoor application, and especially when there are RF circuitries and components in the system, Thus the interference among the system board and ~~the expansion add-on expansion daughter~~ boards increases. [[Whole system became unstable, if no interference proof means is implemented.]] Obviously, sufficient EMI proof means and heat conduction means are needed to be implemented, to ensure system function properly.

[[When applying a system in a particular space limited application, it's hard to shield the electromagnetic wave interference and dissipate the heat among the boards. So, regular design PC cannot be used in many applications, which need to meet the requirements of critical environment. They may cause malfunction of the system for the time being.

Furthermore in some special applications, the interference among the expansion boards and the system board is very strong because of one or more radio frequency circuit boards involved. If there is not proper shield among the system board and the expansion boards, the system even cannot work.]]

5 In the prior art of work, there are a variety of solutions to shield the components on a PCB, or shield a group of small assembly and then install them in a bigger PCB. Those designs provide a EMI shielding on the component level. However, on the system design level, especially, when an embedded computer system with different type of add-on expansion daughter cards, a system level EMI shield and heat
 10 conduction implementation is needed to ensure the whole system performance as well as keep the flexibility of the adaptation of different types of add-on expansion daughter cards.

Obviously, better solution is needed.

15 **Summary**

The present invention provides a computer system board with ~~dual shield and heat sink expansion~~ dual complete EMI shield and heat conduction expansion
 20 apparatuses for limit-space space limited and critical application circumstance. The shield expansion ~~houses~~ apparatuses provide [[EMI shield and heat conduct]]
complete EMI shield and sufficient heat conduction for the ~~daughter board inside~~
add-on expansion daughter cards inside them. The shield expansion [[housing solutions comprise]] apparatus comprises an on PCB expansion zone, and a special shield metal housing cover with heat sink that covers the whole expansion zone after
 25 an expansion board is installed on to the system board. The expansion zone is a large ~~ground plate of~~ copper clad ground plane on the PCB with connectors~~[[, which can connect with the add-on expansion board]]~~ for connecting with add-on expansion daughter cards.

30 The ~~shield~~ metal housing cover and the on PCB shield expansion zone ~~works~~ work together to conduct the heat generated by the expansion board sealed inside, and, also ~~shields~~ completely shield the electromagnetic wave interference between

the ~~expansion board and outside house~~ add-on expansion daughter card and the environment outside of the shield expansion apparatus. In my example, dual shield expansion housing design with high heat sink especially eliminates the cross RF interference under the situation when there are two expansion boards doing radio frequency applications which are installed on to the system.

Objects and Advantages

Accordingly, several objects and advantages are achieved by providing shield expansion houses on the system board of my invention:

- 1) to provide [[highly stable and reliable applications of a computer system board in a limited space by the shield expansion housing solution of current invention;]] a computer system board with add-on expansion daughter cards in a space limited environment with high reliability and stability by the complete shield expansion apparatuses of current invention;
- 2) to use the shield metal housing cover as well as the heat sink to provide high heat ~~dispatching~~ dispassion capability for the expansion board;
- 3) to shield the electromagnetic wave interference among the [[expansion board]] add-on expansion daughter cards and the system board.

The forgoing features and advantages of the present invention can be appreciated more fully from the following description, with references to the accompanying drawings in which.

Brief Description of the Drawings

Fig. 1 is a diagrammatic view of a system board design with the present invention.

Fig. 1A is a cut away side view of the system board taken along line A-A of Fig.1; and the side view of the expansion board, the shield metal housing cover and the add-on extra heat sink.

5 Fig. 2 is an enlarged view of the shield metal housing cover and the expansion board.

DESCRIPTION-Preferred Embodiment

10 Fig. 1 is a diagrammatic view of a system board design with the present invention. As shown in this embodiment, the computer system board 10 comprises a PCB 13, a processor 14, the connector 16 (optional), other ICs 15,17 and on PCB expansion zones 11 & 12. The connector 16 makes it possible for the system level expansion with other system boards (not shown). Through this connector 16, more
15 system boards can be stackable, thus it allows more expansion boards to fit into a particular space and can process more applications.

On the system board 10, two on PCB shield expansion zones 11, 12 comprise shield areas 112, 122 which are part of ground copper clad laminate on the PCB with
20 insulation; soldering zones 111&121, which can be soldered together with a shield metal housing cover (referring to Fig.2 the shield metal housing cover 20); and expansion connectors 113, 123. Once the shield metal housing cover 20 is mounted on to the shield expansion zone 11 or 12, they can form a complete shield house with heat sink feature. The expansion boards connecting with the system board through the
25 expansion connectors 113 or 123 process the according applications while they are isolated from electromagnetic wave interference with the electronics outside the house. Meanwhile, electronics sealed inside the house have a good heat distribution environment.

30 Fig. 1A is a cut away side view of the system board taken along line A-A of Fig.1; and the side view of the expansion board, the shield metal housing cover and the add-on extra heat sink. As shown, the expansion board 21 with connector 212 can be

plugged into the expansion connector 123 and mounted on to the system board 10. The components 215 & 216, which need high heat distribution, have the heat conductor blades 213 & 214 on them. After the expansion board 21 is mounted on the system board 10, the shield metal housing cover 20 can cover the shield expansion zone 12 and be mounted on the system board also. The heat conductor blades 213 and 214 touch the shield metal housing cover 20 and conduct the heat from the IC 215 and 216; thus, the shield metal housing cover 20 becomes the heat sink of the whole expansion board. For heavy duty expansion board, which may generates more heat, an add-on, extra heat sink 22 is attached to the shield metal housing cover 20 to provide extra heat distributing ability for the expansion board.

Fig.2 is an enlarged view of the shield metal housing cover and expansion board. As shown in this embodiment, the shield metal housing cover 20 is an open metal box with four small soldering edges 201,202,203 and 204, which can be soldered on to the soldering zone (referring to 111 or 121 of Fig. 1) of the system board 10. This forms the complete shield house for the expansion board 21. In some special cases, there may be holes need on the shield metal housing cover in order for some of the circuit of the expansion board 21 to extend out of the shield metal housing cover. The expansion board 21 is an individual electronic circuit board, which can perform certain functions; for instance, example a LAN card to provide networking functions for the system board. The expansion board 21 comprises a PCB 211 and a connector 212 that can be connected to the expansion connector (referring to 113 and 123 of Fig.1) in the shield expansion zone (referring to 11 and 12 of the Fig.1). Once the expansion board is sealed in to the shield house, the airflow inside the house is the heat conductor for all the components. On the PCB 211, there are ICs 215,216,217,and 218. Heat conduct blades 213 and 214 are added on to IC 215 & 216 to provide better heat distribution. An add-on extra hest sink 22 is added on to the shield metal housing cover 20 when better heat distribution is required.

30 **Conclusion, Ramifications, and Scope**

Accordingly, the reader can see, I've provided a computer system board with dual complete shield expansion housing solutions apparatuses. [[With the PCB

structure of the current invention, the complete system board has more compact space and whole system is easier to fit into smaller space.]] The computer system board and its complete shield expansion apparatuses of current invention has a compact size and can be easily fit into small application environment. [[With the shield expansion housing solution of the current invention, more applications can be processed reliability and stably on the system board with no interference as well as good heat dissipation.]] The complete shield expansion apparatuses of current invention enable versatile system hardware expansions by eliminating EMI and providing good heat dissipation for the add-on expansion daughter cards. Dual shield expansion housing design especially benefit to eliminate the cross interference with high heat sink ability under the situation when there are two radio frequency application expansion boards installed on to the system board.

Although the description above contains much specificity, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Various other embodiments and ramifications are possible within its scope. For example:

- For stackable system board, it allows more expansion boards to fit into a particular space and can process more applications.
- One system board can be designed with more than two shield expansion zones apparatuses.
- A system board may comprise multiple expansion zones apparatuses on both side of the PCB.
- A system board may comprise different size of the expansion zone- apparatuses.
- For special type of expansion boards, an expansion zone- apparatus may comprise more than one connector and other means to joint the expansion boards with the system board.
- A shield expansion housing solution apparatus may have some holes conducting circuit from inside to outside.

Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.

Claims: What is claimed is:

- 11(new). A complete EMI shield expansion housing apparatuses for add-on
 5 expansion daughter board for computer system board comprising:
 an on computer system board PCB shield zone, and
 a metallic expansion housing cover, and
 an add-on expansion daughter board,
 whereby, after the said add-on expansion daughter board is mounted onto the
 10 said on computer system board PCB shield zone, the said metallic
 expansion housing cover is soldered onto the said on computer system
 board PCB shield zone covering the said add-on expansion daughter
 board.
- 12(new). The on computer system board PCB shield zone of claim 11 is a
 15 copper clad ground plane PCB area fabricated on computer system board
 PCB as part of the computer system board PCB with solderable
 surrounding zone where the said metallic expansion housing cover of
 claim 11 can be soldered on to.
- 13(new). The on computer system board PCB shield zone of claim 11
 20 installed with at least one connector for installing of said add-on expansion
 daughter board of claim 11.
- 14(new). The said connector/s of claim 13 is soldered on computer system
 board inside of the said the on computer system board PCB shield zone of
 claim 11.
- 25 15(new). The said connector/s of claim 13 is providing mechanical support
 for attaching the said add-on expansion daughter board of claim 11 onto
 the computer system board with necessary help of other mounting means.
- 16(new). The said add-on expansion daughter card of claim 11 has connector
 means for attaching to the corresponding said connector/s of claim 13.
- 30 17(new). The said add-on expansion daughter card of claim 11 is attached to
 the computer system board via the corresponding said connector of claim
 13 within the on computer system board PCB shield zone of claim 11.

18(new). The metallic expansion housing cover of claim 11 is a metallic cover box with an open base that can be soldered onto the corresponding solderable surrounding zone of claim 12.

5 20(new). metallic expansion housing cover of claim 11 soldered onto said on PCB shield zone of claim 11 form a complete metallic shield apparatus for the add-on expansion daughter card and other electronics inside the apparatus.

21(new). A complete EMI shield and heat conduction expansion housing apparatus
10 for add-on expansion daughter board for computer system board comprising:
a said complete EMI shield expansion housing apparatuses of claim 11
a plurality of heat conduction means

22(new). The said heat conduction means of claim 21 are attached between
the add-on expansion daughter board of claim 11 and the metallic
15 expansion housing cover of claim 11.

23(new). The said apparatus of claim 21 utilizing the said metallic expansion housing cover of claim 11 as heat sink for the heat that generated inside the apparatus of claim 11 and conducted to it by the heat conduction means of claim 21.

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24(new). A computer system board with a plurality of complete EMI shield expansion housing apparatuses for add-on expansion daughter boards comprising:

a plurality of said complete EMI shield expansion housing apparatuses of
25 claim 11 and/or said complete EMI shield with heat conduction expansion housing apparatuses of claim 18

25(new). The said shield expansion housing apparatuses for add-on expansion board claim 28 are mechanically isolated from each other with certain spacing in order to apply soldering during the assembly.

30 26(new). A stackable computer system board with a plurality of complete EMI shield expansion housing apparatuses for add-on expansion daughter board comprising:

a computer system board with a plurality of complete EMI shield expansion housing apparatuses for add-on expansion daughter boards of claim 24, and a stackable connector means on the said computer system board for stacking the computer system boards together electronically and mechanically with helps of other mounting means.

Whereby, a plurality of said stackable computer system boards are stacking mounted together via the stackable connector means.

Abstract:

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A compact computer system board 10 comprises dual shield on PCB expansion zones 11, 12, expansion connectors 113, 123 which can be connected to expansion boards. Once a expansion board is connected to the expansion connector 113 (123) in the shield on PCB expansion zone 11 (12) to extent the application of the system 10, ~~the shield~~ a metal housing cover 20 will be mounted above the shield on PCB expansion zone 11(12). The shield expansion house apparatus formed by shield on PCB expansion zone 11(12) and ~~shield-metal~~ metal housing cover 20 isolates the electromagnetic interference between [[expansion board and the outside surrounding]] add-on expansion daughter card and the environment outside of the shield expansion apparatus. The ~~shield-metal~~ metal housing cover 20 as well as the shield on PCB expansion zone 11 (12) is function as the heat sink of the ~~board inside~~ add-on expansion daughter card inside the apparatus. [[The shield expansion housing solutions guarantee the system processing high reliability and stably in the limited space of the system board.]] Dual [[expansion housing solutions]] complete EMI shield expansion apparatuses especially eliminate the cross interference [[with high heat sink ability]] and provide high heat dispassion for the system under the situation when there are two radio frequency application expansion boards installed ~~on to~~ onto the system board.

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